

OPEN ACCESS

Regional Design Approach in Designing Climatic Responsive Administrative Building in the 21st Century

To cite this article: Hazrina Binti Haja Bava Mohidin and Alice Sabrina Ismail 2015 *IOP Conf. Ser.: Earth Environ. Sci.* **23** 012016

View the [article online](#) for updates and enhancements.

You may also like

- [Evaluating nighttime lights and population distribution as proxies for mapping anthropogenic CO₂ emission in Vietnam, Cambodia and Laos](#)
Andrea E Gaughan, Tomohiro Oda, Alessandro Sorichetta et al.
- [Application of Computer Technology in Administrative Management](#)
Shaoxi Li
- [Assessment of nanoparticles and metal exposure of airport workers using exhaled breath condensate](#)
Caroline Marie-Desvergne, Muriel Dubosson, Léa Touri et al.



The Electrochemical Society
Advancing solid state & electrochemical science & technology

242nd ECS Meeting

Oct 9 – 13, 2022 • Atlanta, GA, US

Abstract submission deadline: **April 8, 2022**

Connect. Engage. Champion. Empower. Accelerate.

MOVE SCIENCE FORWARD



Submit your abstract



Regional Design Approach in Designing Climatic Responsive Administrative Building in the 21st Century

Hazrina Binti Haja Bava Mohidin¹, Alice Sabrina Ismail

Department of Architecture, Faculty of Built Environment, Universiti Teknologi Malaysia, Skudai. 81310, Johor, Malaysia

E-mail: hazrinahaja@gmail.com

Abstract. The objective of this paper is to explicate on the study of modern administrative building in Malaysia which portrays regional design approach that conforms to the local context and climate by reviewing two case studies; Perdana Putra (1999) and former Prime Minister's Office (1967). This paper is significant because the country's stature and political statement was symbolized by administrative building as a national icon. In other words, it is also viewed as a cultural object that is closely tied to a particular social context and nation historical moment. Administrative building, therefore, may exhibit various meanings. This paper uses structuralism paradigm and semiotic principles as a methodological approach. This paper is of importance for practicing architects and society in the future as it offers new knowledge and understanding in identifying the suitable climatic consideration that may reflect regionalist design approach in modern administrative building. These elements then may be adopted in designing public buildings in the future with regional values that are important for expressing national culture to symbolize the identity of place and society as well as responsive to climate change.

1. Introduction

This paper seeks to elucidate the built form composition of the highest administrative architecture in Malaysia. This study is important because present administrative architecture much portrays eclectic style that incorporates the Greek and Roman, Persian and the Malay vernacular. This mixture of styles caused local identity and values through design lack regional characteristics that suit the local climate and context.

Although there were published writings on administrative building done in the past by architects and academicians like Lai Chee Kien (2007), Izani et al (2009), Rasdi (2001), Ismail (2008), Endut (2001), Vlatseas (2001), Kosman and Nik Ibrahim (2007), Moser (2009), King (2008), Johan Ariffini (2003) and Ho (2006), their works did not include any analysis of the overall administration building from the aspect of façade design or how they should portray regional design approach responsive to local climatic condition. In sum, a survey of the published sources reveals that there is a gap in the literature of the administrative building in Malaysia. To address this gap and to achieve the objective of the study, this paper focuses on documenting regional design characteristics on administrative architecture to produce suitable guidelines in designing better administrative building with consideration to regional characteristics in the future.

2. Background Study

2.1. Defining the Administrative Architecture and arising design issues relating to administrative building in Malaysia

¹ To whom any correspondence should be addressed.



An administrative architecture is a building that accommodates the work of administrators despite their levels to perform all related administrative activities, apart from serving as a place to run the seat of the government. The building is also located in important areas as the capital and houses the office of the government's lawmakers [1]. Administrative buildings are usually built not only to symbolize power and authority of the government, but also to portray the identity of the society at country, states, region, district and communal level to the outside world [1, 2]. At country level, the most important type is the Prime Minister's Office or also known as the capitol complex [1].

However, in the context of Malaysia, many public buildings including the administrative building portray less sensitiveness to design approach that is responsive to the local climatic context. For example, most of the country's administrative building were designed to fit the patrons intend which is usually biased towards the visual impressiveness instead of focusing more on the user comfort. It is heartbreaking to see that Malaysian architecture adapt less to its natural context even if it is abundance in natural resources. Since the highlight of this paper is on the issue of responsive administrative architecture design, it is worthwhile to understand and define the meaning of regional approach design before delving into the two case studies followed by suggestions on how to improve the quality of building design that responds to local climate for future reference.

2.2 Regional approach design and attributes

Regional architecture became a topic that was debated since early modernist era. The term regionalism is defined as a set of associated conditions [3, 4]. Regionalism in the built environment takes into account the practice of architecture within the same doctrine, system, principles such as a municipality or even a small area that shares the same geographical, social, economic and cultural factors. In other words, there are three main components that contribute to the identification of regional values in built form. They are; geography (topography, land, landscape, and climate), local architecture (technology, structural and construction material as well as method of construction) and lastly, local culture (customs, traditions and manners) [4, 5]. Regionalism became favorable and soon the modernist knowledge spread worldwide, which resulted in regionalism to be transplanted globally, even in the tropical regions such as in Malaysia during the late 19th century [6, 7, 8].

2.3 Architectural attributes in determining regional design approach

The research on regional climatic approach on administrative architecture started when indoor comfort is being negotiated which results to non-conducive environment to the occupant of the building. During the planning stage, two case studies were selected based on the same architectural typology; government administrative building. Research was conducted on the exterior facade of the building to study the facade elements. Based on the findings, in order to produce built form that portrays sensitiveness to local climate, many scholars and designers agreed that there are four main architectural elements that should be primarily considered in order to achieve a comfortable indoor occupancy passively. They are – a) roof, b) wall, c) opening, and d) landscape [9 - 11]. However, it was agreed that high-energy consumption as well as indoor comfort are dependent on building facade as it is primarily the main component that sets the tone to the building [11]. Hence for the benefit of this study, only facade elements like roof, wall and opening will be discussed, as it is the most important architectural element that acts as an envelope for the building. To increase the value of the facade design that complies with regional needs, past scholars outlined that exterior building facade should minimize internal heat gain during daytime while decreases direct solar radiation. This could be achieved by providing many shades from sunlight, rain and water runoffs, as well as emphasis on the usage of regional material for the outer skin [9, 11]. Alongside to this, the building envelope should be affordable, durable, energy-positive, environmentally sensitive, healthy and comfortable as well as intelligent [10]. There are three basic characteristics that promote regional facade design that conforms to regional condition in a hot and humid climate. These basic characteristics are; a) energy efficiency, b) facade types, and c) materials [9-11]. Below are the outlined attributes in determining a building with regional design approach based on studies conducted by [7, 9-11]

Table 2.1. Strategies in responsive design

Characteristics	Key Concept	Strategies
a. Energy Efficiency	Reduction of External Heat Gain protection of the facade from direct solar radiation through self-shading methods (building form) or shading devices	<ul style="list-style-type: none"> • Large and high roof either domed or pitched • Verandah to cool off building • Large openings to allow air movement
Ways of minimizing mechanical aids in design	Cooling use of natural ventilation where environmental characteristics and	<ul style="list-style-type: none"> • vented to discharge hot air accumulation beneath the ceiling • Double glazed windows to reflect unwanted heat

	building function permit	<ul style="list-style-type: none"> from entering interior building Intelligent fenestration – allowing cool air while shading Full height windows
	Daylight use of natural light sources while minimizing solar heat gain through use of shading devices and light shelves	<ul style="list-style-type: none"> Use of skylight to maximize natural light infusion Vertical and horizontal elements create natural shading or shadowing Punched or recessed wall Adequate placement of openings for maximum air-flow
b. Façade Types Passive approach in achieving indoor comfort	Solar Control protection of the facade from direct solar radiation through self-shading methods (building form) or shading devices	<ul style="list-style-type: none"> Wide overhangs Tilted (25°C) façade to admit more desirable light diffusion into building Tiered or staggered Shaded – punched or recessed windows
	Thermal and Moisture Resistant use of passive skin approach to protect building from eroding	<ul style="list-style-type: none"> Double skin façade – cavity wall to create double thermal and moisture barrier
c. Materials Material options without compromising economy, utility, durability, and comfort	Lightweight material low thermal capacity materials to keep building cool	<ul style="list-style-type: none"> Wood and other natural material that has low thermal capacity Use of natural material insulator
	Resource Efficiency consideration of building's life-cycle from design, construction, operation, maintenance, renovation, and demolition.	<ul style="list-style-type: none"> Natural resources obtained locally Long life-cycle Low cost of handling Easily maintained Environment friendly Easily constructed material – extraction, process, transport, install, operation, erection
	Color surface of facade	<ul style="list-style-type: none"> Lighter color reflect heat while darker color absorb more solar radiation

3. Method of Study

In trying to explain and describe how the regional design approach is adopted in the two chosen case studies, the administrative buildings are studied in a qualitative manner. This is conducted by giving emphasis on the aspect of building communication since it involves the study of meaning and building as a sign. Due to this reason, structuralism as research paradigm and semiotics as research methodology is adopted since they help to explain how built form may convey meaning through the portrayal of various architectural elements [12, 13]. Due to the limitation of the study, only the external façade of administrative buildings will be used as the basis of this study. This research will adopt direct observation as a method for data collection and layering theory as a basis of analyzing the building skin [12, 14].

3.1 Research methodology

Semiotics, in its most basic definition is the study of signs [13]. The theory of semiotic was developed by scholars such as Roland Barthes and Mark Gottdiener. It is claimed that semiotics exists in a triadic notion. The systems of signification (relationship between the signifier and signified) are multileveled structures, which not only contain denotative signs but also connotative signs when particular cultural codes are ascribed to these signs. Architecture can be fitted into the triadic notion of understanding semiotics as it includes the relationship of the signifier and the signified in a multilevel structure [13]. Therefore, for the benefit of this paper, this theory of semiotics is adapted as it will help to describe and define the meaning of the administrative architecture external facade as a meaningful 'sign.' Data collection will involve direct observation of external façade treatment that will concern roof, wall, and openings. The process of analysis will be further clarified in Table 3.1 below.

3.2 Method of data collection

Direct observation enables diverseness and vastness of context. In this case, direct observation is beneficial to the study because administrative buildings chosen for this study is restricted in its political nature since these buildings are the most important administrative buildings in Malaysia.

Table 3.1 Method of data collection

Building Indicator	Theory To Analyze	Process of Analysis
Roof, Wall and Openings	Layering technique to analyze the composition of façade elements [14]	1. Observe and identify architectural elements on overall facade 2. Use layering system is to identify elements of form with the following steps: Layer 1: the main form Layer 2: additional built form Layer 3: basic primary elements Layer 4: additional and secondary elements Layer 5: constructive and decorative details Layer 6: entire range of stylistic features

4. Findings

4.1 Background Study

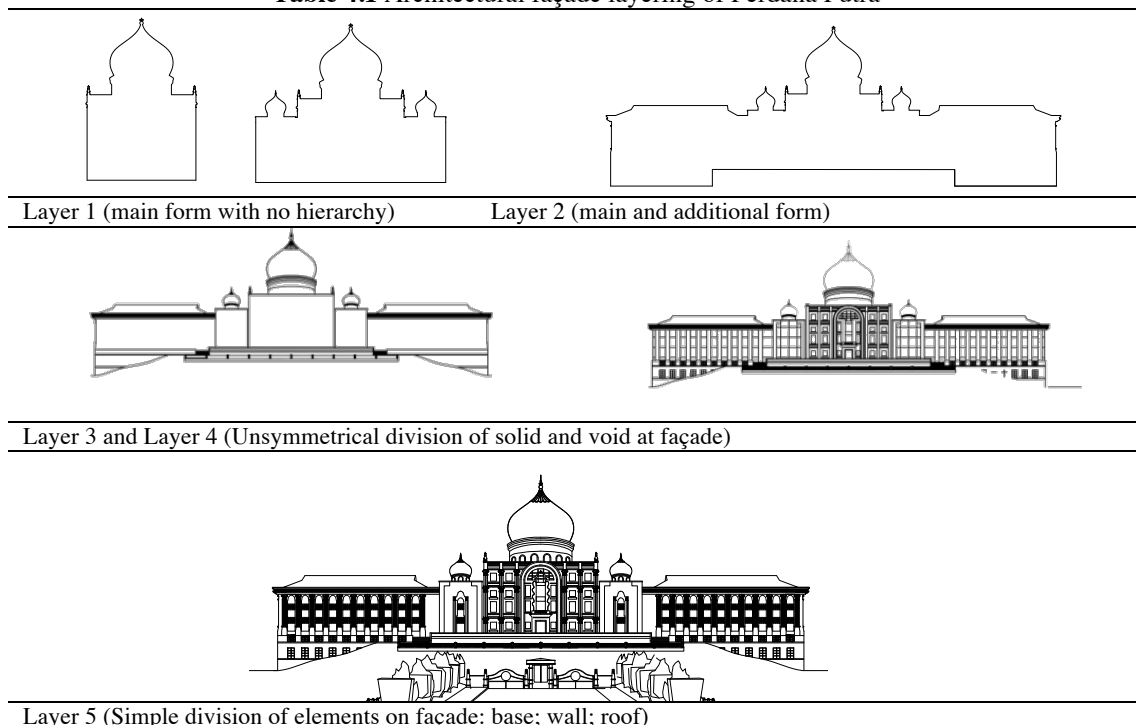
4.1.1. Perdana Putra (1999), Putrajaya. Completed in 1999 on a 5 acre land and cost RM270 million with only 10% imported materials incorporated into the design due to the 1997/1998 economic crisis, Perdana Putra was built to complement the federal administrative territory of Putrajaya. All the consultants were locally handpicked, and the principal architect in charged was Ar. Ahmad Rozi Abd Wahab from AQIDEA.

4.1.2 Former Prime Minister’s (PM’s) Office (1967), Kuala Lumpur. In September 1967, the former PM’s office building was officially opened for operation. The office building is three storeys in height and sits on a 0.25-acre land. The cost of construction was RM 1 million using sandblasted concrete as its main façade finishes and structured on reinforced concrete post and beam. The Public Works Department did the overall design and construction of the building while Tunku and the architect initiated most of the design ideas. The former PM’s office had accommodated four Prime Ministers before Putrajaya took over the administrative role.

4.2 Architectural Façade Analysis (Layering technique)

4.2.1 Perdana Putra (1999), Putrajaya

Table 4.1 Architectural façade layering of Perdana Putra





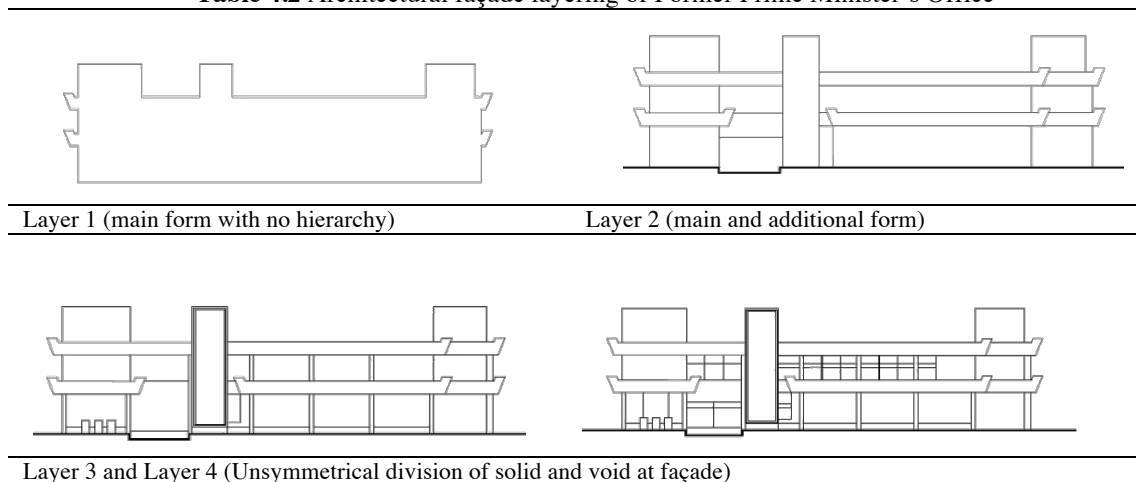
4.2.1.1. *Roof.* Since roof is the main sheltering element of a building, its primary function is to shade the building as a whole. Perdana Putra uses two types of roof. These roofs are pitched on both ends while domed at the center of the façade. The pitched roof selected for the left and right wing of the building symbolizes the Malay architecture feature where the roof is designed to have a certain length of overhang to shade the immediate wall from solar radiation and rain as well as water runoff. As pitched roof is made of metal roofing that is a non-reflective material and has a greater height in the middle, it is logically more effective in creating less hot air pocket under the ceiling as the height has been increased. The same idea was adapted on the Indo-Saracenic and Moguls influenced green domed roofing and this ensures better indoor air quality. However, the material used for the domed roof; green stone is rather reflective and can easily ignite thermal conductivity. The light green color roofing reduces heat gain as well as reducing glare.

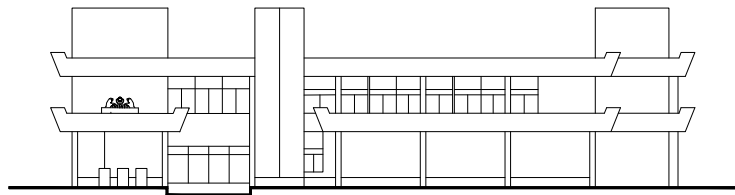
4.2.1.2. *Wall.* The wall of Perdana Putra is composed of large arches that create recessed wall and helps to shade the double-glazed full sized window. These arches are adaptation of Baroque and Neo-classicism architecture style that originated from France. The wall of Perdana Putra created a sense of interaction between interior and exterior space that was idealized by adopting concrete wall façade with openings that are full in height. It is also embellished with Classical ordered - Ionic columns that create further recess on the façade. The wall uses granite stone as one of the main materials. These granite stones are lightly colored, and its surface is not shiny that helps to reduce the heat gain. The availability of a verandah on the center building helps to reduce the cooling load by minimizing usage of mechanical services.

4.2.1.3. *Opening* The large opening of Perdana Putra are full in height and are embellished with wrought iron grill detailing that originates from a combination of Islamic arts and art nouveau architecture style. These styles are clearly seen on the large center arch that is heavily emphasised. The recessed double glazed windows reduce solar radiation while allowing natural daylighting as well as air to enter the inside spaces of the building. There are also opening on the dome's sanctuary to help reduce hot air that rises from the bottom to top by means of stack effect.

4.2.2 Former Prime Minister's Office (1967), Kuala Lumpur

Table 4.2 Architectural façade layering of Former Prime Minister's Office





Layer 5 (Simple division of elements on façade: base; wall; roof)

Façade elements



Layer 6 (Simple use of detailing and elements on façade)

4.2.2.1 Roof. The former Prime Minister's (PM's) office has a flat roof covering the building as a whole. It is being designed in a staggered and tiered manner that shades not only the immediate wall and openings but also shelters all floor levels as well. Although being flat in nature, the roof of this building had a long overhang and cantilevered at all façade of the building creating a recessed wall that could shade better and helps to reduce the usage of mechanical cooling system within the interior spaces. The roof material is of non-reflective source that does not cause thermal conductivity. Being brutalist-expressionism in style, the roof of this building is made of bare and exposed materials using abrasive sandblasted concrete and stucco.

4.2.2.2 Wall. The wall of former PM's office is rich in its horizontal and vertical elements that create one or more ways to adapt better in the region's climatic condition. These horizontal elements gave a deep recess to the wall and this result to a better shading solution on every floor level. The wall treatments are made of the same material used consistently throughout the façade. Sandblasted concrete and stucco are the two choices of material that was being considered to be effective in keeping heat during night times while resisting heat load during the day. However, these materials are dark in color making it better in heat absorption.

4.2.2.3 Openings. The interior and exterior spaces of the building are modeled to have a sense of interaction where large windows are placed on its façade. These windows are also recessed to allow good daylighting penetration while eliminating glare and solar radiation. It is also rain reflective and avoids water run-offs at each opening, and at the same time this could reduce the formation of mould as an effect of high humidity level. There is also a high degree of protruding façade on its main opening, giving good protection against the weather as well good air circulation and distribution.

5. Analyses and Discussion

Table 5.1 architectural façade analyses on two administrative architecture in Malaysia

Façade Elements	Required Characteristics (Guidelines)	Perdana Putra	Former PM's Office
Roof	• Large and high roof either domed or pitched	/	
	• vented to discharge hot air accumulation beneath the ceiling	/	
	• Use of skylight to maximize natural light infusion		
	• Wide overhangs	/	/
	• Lightweight material	/	/
	• Resource Efficiency	/	/
	• Light colored surface	/	
Wall	• Verandah to cool off building	/	
	• Double glazed windows to reflect unwanted heat	/	/
	• Vertical and horizontal elements create natural shading or shadowing	/	/
	• Punched or recessed wall	/	/
	• Tilted (25 °C) façade to admit more desirable light diffusion into building		
	• Tiered or staggered		/

	• Double skin façade – cavity wall to create thermal and moisture barrier		
	• Lightweight material	/	/
	• Resource Efficiency	/	/
	• Light colored surface	/	
Openings	• Large openings to allow air movement	/	/
	• Intelligent fenestration – allowing cool air while shading		
	• Full height windows	/	/
	• Adequate placement of openings for maximum air-flow	/	/
	• Shaded – punched or recessed windows	/	/
	• Lightweight material	/	/
	• Resource Efficiency	/	/
	• Light colored surface		

It can be seen that Perdana Putra adapts more to the climatic condition in all façade elements; roof, wall and openings. As compared to former PM's office, Perdana Putra has a better approach on its roof style. Although, on the overall comment, Perdana Putra seems to be more responsive, it lacks in its wall design approach. The former PM's office has a better wall design approach as the tiered and staggered design enable the building to be shaded naturally. As for the opening, Perdana Putra and the former PM's office are equally responsive based on the façade analysis.

6. Conclusion

Indoor comfort is one of the main factors for a productive employee, and therefore, an administrative building is required to meet responsive design standard especially on façade design as the building envelope. It is highly recommended that future architects and policy makers to follow the guidelines as stated in table 5.1 as an effective adaptation on façade design as façade is the main architectural element that is commonly exposed to harsh climatic conditions and as an intelligent measure in reducing energy consumption loading in administrative building particularly. This paper will also benefit the public at large, being part of the user of the building, as it will educate them to appreciate architectural façade appropriately so as to maximize comfort by optimizing façade elements. The research on regional design approach can be expanded to other architectural elements such as the form of the building and spatial arrangement. The guideline in table 5.1 can also be used as a tool to examine the regional climatic approach on other typological buildings especially public government buildings.

References

- [1] Vale, J. Lawrence (2008) *Architecture, Power, and National Identity*. London and New York: Routledge.
- [2] De Rossi, A. (2009). *Grande SCALA. Architecture Politic Form*. List Laboratorio Internazionale Editoriale.
- [3] Dickinson, R. E. (2013). *City, Region And Regionalism: A Geographical Contribution To Human Ecology*. Routledge.
- [4] Mursib, G. (2008). *Pemikiran dan sahutan regionalisme dalam wacana senibina Malaysia* (Doctoral dissertation, Universiti Teknologi Malaysia, Faculty of Built Environment).
- [5] Marhani, M. A., Adnan, H., & Ismail, F. (2013). OHSAS 18001: A Pilot Study of Towards Sustainable Construction in Malaysia. *Procedia-Social and Behavioral Sciences*,(ajE-Bs) 85, 51-60. (5)
- [6] Bay, J. H., & Ong, B. L. (Eds.). (2007). *Tropical Regional Architecture*. Routledge.
- [7] Ahmad, M. H. (2005). *Can Climates Response Become An Essential Lingua Franca For Malay Architecture? International Seminar, Malay Architecture As Lingua Franca*, June 22 & 23, 2005, Trisakti University, Jakarta, Indonesia (
- [8] Ismail, A. S. (2002). *Gagasan Pemikiran Frank Lloyd Wright Ke Arah Pembentukan Identiti Seni Bina di Malaysia*. Malaysia: Desktop Publication.
- [9] Hyde, R. (2013). *Climate Responsive Design: A Study Of Buildings In Moderate And Hot Humid Climates*. Taylor & Francis.
- [10] Haase, M., & Amato, A. (2006, September). Regional Façade Design For Zero Energy Buildings In The Tropics. In *Clever Design, Affordable Comfort–Proceedings Of The 23rd International Conference On Passive And Low Energy Architecture (Plea)*, Geneva, Switzerland.
- [11] Ahmad, M. H., Ossen, D. R., & Lim, Y. W. (2008). Review on solar shading strategies and measuring tools for building energy efficiency in tropical climate. *10th SENVAR + 2nd ISESEE 2008 Humanity & Technology*, 2008, Shah Alam.
- [12] Ismail, A. S. (2008) *A multidisciplinary approach in understanding the symbolic meaning of built form*. In: *Methodology in Architectural Research*. Penerbit UTM, Johor, pp. 180-211.
- [13] Leeds-Hurwitz, W. (2012). *Semiotics and communication: Signs, codes, cultures*. Routledge.
- [14] Shatha, M. (2004). Local identity of modern Amman–Jordan: a perceptual approach towards identifying an inter-subjective and shared architectural schemata. *Urban design international*, 9(3), 119-131.